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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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EXAMINER

LEWIS, MONICA

ART UNIT

PAPER NUMBER

2822

DATE MAILED: 09/27/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

| | | | |
|-----------------|--------------|--------------|---------------|
| Application No. | 10/044,427 | Applicant(s) | HERMAN ET AL. |
| Examiner | Monica Lewis | Art Unit | 2822 |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) Responsive to communication(s) filed on 09 November 2001.

2a) This action is FINAL. 2b) This action is non-final.

3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) Claim(s) 1-7 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) Claim(s) _____ is/are allowed.

6) Claim(s) 1-7 is/are rejected.

7) Claim(s) _____ is/are objected to.

8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) The specification is objected to by the Examiner.

10) The drawing(s) filed on 09 November 2001 is/are: a) accepted or b) objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) The proposed drawing correction filed on _____ is: a) approved b) disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12) The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) All b) Some * c) None of:

1. Certified copies of the priority documents have been received.

2. Certified copies of the priority documents have been received in Application No. _____.

3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) The translation of the foreign language provisional application has been received.

15) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) Notice of References Cited (PTO-892) 4) Interview Summary (PTO-413) Paper No(s). _____.

2) Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) Notice of Informal Patent Application (PTO-152)

3) Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____. 6) Other: _____.

DETAILED ACTION

1. This action is in response to the application filed November 9, 2001.

Oath/Declaration

2. The oath or declaration is defective. A new oath or declaration in compliance with 37 CFR 1.67(a) identifying this application by application number and filing date is required. See MPEP §§ 602.01 and 602.02.

The oath or declaration is defective because:

Non-initialed and/or non-dated alterations have been made to the oath or declaration. See 37 CFR 1.52(c).

Claim Objections

3. Claim 1 is objected to because of the following informalities: a) it is not clear whether the channel region has a first or second conductivity type (See Claim 1 Lines 4-7). Appropriate correction is required.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 1-7 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is not clear what is meant by the following:
 - a) "channels in the space between the peripheries of said channels and their respective sources" (See Claim 1). Claims 2-7, depend directly or indirectly from a rejected claim and are, therefore, also rejected under 35 U.S.C. 112, second paragraph for the reasons set above.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 1-3 are rejected under 35 U.S.C. 103(a) as obvious over Huang (U.S. Patent No. 6,255,692) in view of Lidow et al. (U.S. Patent No. 4,680,853).

In regards to claim 1, Huang discloses the following:

a) a die of monocrystalline silicon (2a) having an upper and lower surface and having a first conductivity type (See Figure 1);

b) a relatively thin layer of epitaxially grown silicon (2) of said first conductivity type atop said top surface (See Figure 1);

c) a plurality of spaced channel regions (12) diffused into the top surface of said epitaxially grown silicon layer (See Figure 1);

d) a respective source region (1) of smaller area than said channel regions diffused into each of said channel regions and defining lateral invertible channels in the space between peripheries of said channels and their respective sources (See Figure 1);

e) a MOSgate structure overlying each of said invertible channel (See Figure 1);

f) a source electrode (21) overlying the top of said die and connected to each of said channel and source regions, and insulated from said MOSgate structure (See Figure 1);

g) a drain electrode (22) coupled to said epitaxially grown silicon layer (See Figure 1);

h) channel diffusions having a depth less than 3 microns, and said source diffusion having a depth less than .3 microns (See Column 6 Lines 24-64).

In regards to claim 1, Huang fails to disclose the following:

- a) channel region of a second conductivity.

However, Lidow et al. ("Lidow") discloses a channel that has a second conductivity type (See Figure 20). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Huang to include a channel that has a second conductivity type as disclosed in Lidow because it aids in decreasing the forward resistance of the MOSFET.

In regards to claim 2, Huang discloses the following:

- a) first and second conductivity types are N and P respectively (See Column 3 Lines 4 and 6).

In regards to claim 3, Huang discloses the following:

- a) invertible channels have a length of less then about 1 micron (See Column 6 Lines 24-64).

In regards to claim 3, Huang fails to disclose the following:

- a) distance between source and channel regions at their corner points of maximum curvature is about 2.5 microns.

However, the applicant has not established the critical nature of the dimension of 2.5 microns. "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990).

8. Claims 4-7 are rejected under 35 U.S.C. 103(a) as obvious over Huang (U.S. Patent No. 6,255,692) in view of Lidow et al. (U.S. Patent No. 4,680,853), Applicant's Prior Art and Kinzer (U.S. Patent No. 5,940,721).

In regards to claims 4-6, Huang discloses the following:

a) a rectangular trench extending through the center of each of said source regions and into its respective channel region (See Figure 1).

In regards to claims 4-6, Huang fails to disclose the following:

a) a high concentration contact diffusion of said first conductivity type disposed in the bottom of said trench.

However, Applicant's Prior Art discloses a contact diffusion disposed in the bottom of said trench (20) (See Figure 1). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Huang to include a contact diffusion disposed in the bottom of said trench as disclosed in Applicant's Prior Art because it aids in serving as a good contact region for the body diode.

b) source contact filling said trench and contacting said high concentration diffusion.

However, Kinzer et al. ("Kinzer") discloses a source contact (84) filling the trench (See Figure 3). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Huang to include a source contact filling the trench as disclosed in Kinzer because it aids in providing a connection among the various regions.

In regards to claim 7, Huang discloses the following:

a) first concentration type is N (See Column 3 Line 7).

In regards to claim 7, Huang fails to disclose the following:

a) high concentration contact diffusion is a phosphorus diffusion formed with an effective implant energy of greater than about 350keV for a singly charged phosphorus ion.

However, the limitation of "high concentration contact diffusion is a phosphorus diffusion" makes it a product by process claim. The MPEP § 2113, states, "Even though product -by[-] process claims are limited by and defined by the process, determination of patentability is based upon the product itself. The patentability of a product does not depend on its method of production. If the product in product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product is made by a different process." *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985)(citations omitted).

A "*product by process*" claim is directed to the product per se, no matter how actually made, *In re Hirao and Sato et al.*, 190 USPQ 15 at 17 (CCPA 1976) (footnote 3). See also *In re Brown and Saffer*, 173 USPQ 685 (CCPA 1972); *In re Luck and Gainer*, 177 USPQ 523 (CCPA 1973); *In re Fessmann*, 180 USPQ 324 (CCPA 1974); and *In re Marosi et al.*, 218 USPQ 289 (CAFC 1983) final product per se which must be determined in a "*product by, all of*" claim, and not the patentability of the process, and that an old or obvious product, whether claimed in "*product by process*" claims or not. Note that Applicant has the burden of proof in such cases, as the above caselaw makes clear.

Conclusion

9. The following prior art made of record and not relied upon is considered pertinent to applicant's disclosure: a) Lidow et al. (U.S. Patent No. 4,705,759) discloses a high power mosfet with low on resistance and high breakdown voltage; b) Takahashi (U.S. Patent No. 5,016,066) discloses a vertical power mosfet; c) Gould (U.S. Patent No. 5,047,833) discloses a solderable front metal contact; d) Fujihira (U.S. Patent No. 5,162,883) discloses an increased voltage mos semiconductor device; k) Ajit et al. (U.S. Patent No. 5,557,127) discloses a termination structure for a mosgated device; l) Itoh (U.S. Patent No. 5,703,390) discloses a semiconductor device having four power mosfets; m) Lidow et al. (U.S. Patent No. 5,742,087) discloses a high power mosfet; n) Merrill et al. (U.S. Patent No. 5,904,510) discloses a power transistor an ultra deep trench; o) Ueno (U.S. Patent No. 6,096,607) discloses a method for manufacturing silicon carbide; p) Patel (U.S. Patent No. 6,207,508 B1) discloses a method of fabricating a radio frequency power mosfet; q) Takeuchi et al. (U.S. Patent No. 6,262,439 B1) discloses a silicon carbide semiconductor; and r) Kawaguchi et al. (U.S. Patent No. 6,297,534 B1) discloses a power semiconductor device.

Art Unit: 2822

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Monica Lewis whose telephone number is 703-305-3743. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on 703-308-4940. The fax phone number for the organization where this application or proceeding is assigned is 703-308-7722 for regular and after final communications. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

ML

September 11, 2002



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